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|  | **Evidence** | **Judgement** |
| 1a | Explains how selective breeding and molecular biology  methods could be used to produce a population of cats  with the short legs.  (i) Selective breeding  E1: bases explanation on the assumption that  the mutated allele is dominant.  E2: breed short-legged offspring together or  with mother.  E3: any short-legged offspring will be either  heterozygous or homozygous dominant.  E4: to find out what they are, carry out a test  cross ie breed with another normal cat  (homozygous recessive).  E5: if no normal size legs offspring occur  (after multiple breedings), then it can be taken  that the tested individual is homozygous for  short legs. This cat can be used for future  breeding. / Any cat that produces offspring  with normal legs is heterozygous and  shouldn’t be used for future breeding.  (ii) Molecular Biology  Transgenesis: pro-nuclear injection of  isolated gene into fertilised egg cell, cell  divides to form embryo, then embryo  implanted into surrogate.  OR  Cloning: Somatic (ie 2N) cell from original  female cat removed (nucleus has mutated  allele), fertilised egg extracted from another  cat, nucleus removed, and egg fused with  donor cell/nucleus (electrical pulse used to  stimulate this), egg divides to form embryo,  then embryo implanted into surrogate. | 6. Covers both selective breeding and one molecular  biology technique. Explains correctly and fully how  the methods can be used to produce a population of  Munchkins. Minimal unnecessary information.  5. Correct and full explanation for one method, the  other is substantially correct but lacks some details.  4. Both methods, substantially correct but lacking in  coverage. Selective breeding must have E1.  3. Addressed both methods but issues with accuracy  and/or coverage. Selective breeding must have E1. /  One method well covered and correct, other hopeless  (but has 1 or 2 correct ideas).  2. Some correct evidence for both methods. / Only  one method answered but answered correctly and in  detail.  1. Some correct biological ideas relevant to the  question. |
| b | Similarities  cloning (not transgenesis) and selective breeding  both transfer whole genome  both selective breeding and cloning have the  potential to reduce genetic variation in population.  Selective breeding  harder to control which genes are passed on until  sure both parents are homozygous  takes several generations  lots of unwanted cats  problems of inbreeding.  Molecular Biology – cloning  if successful the resultant cat is guaranteed to have  the mutation  low success rate / takes time to get a successful  clone.  old cells – aged animal.  Molecular Biology – transgenesis  difficult to successfully insert the gene then  successfully re-implant embryo  possible pleiotropic effects  low success rate / takes time.  Both transgenesis and cloning  more precise than selective breeding  cost / wasteful / low success rate  requires specialists and equipment.  Evaluation / justification examples  cloning may produce heterozygous individuals (as  mother was heterozygous) and suggests a way to  get pure breeding cats  molecular biology techniques have a low success  rate, but only need a few successes to be able to  then breed by conventional means  transgenesis more effective compared with  selective breeding, as only transfer the gene of  interest  both selective breeding and cloning may produce  individuals with undesirable gene combinations as  a result of inbreeding but with transgenesis this is  less likely  both transgenesis and cloning still need further  actions to produce a population – either more  transgenesis / cloning or more likely selective  breeding using the transgenic cats  if transgenesis is followed by cloning, then the  potential for a reduction in genetic diversity still  exists  transgenesis may disrupt genome due to the hit  and miss nature of insertion. This may affect gene  expression if regulatory genes are affected  recognises that cloning and transgenesis have  different issues. | 8. Comparison provides an evaluation of the two methods / justification of the effectiveness / recognises that effectiveness is dependent on interacting factors (see last section in evidence).  6. Uses evidence to compare and contrast both methods. Thorough coverage.  4. Superficial comparison of both methods, but tends to be the obvious evidence eg inbreeding/lack of  genetic variation, time involved, costs.  2. 2–3 pieces of isolated evidence, not comparing the two methods.  1. Some correct biological ideas relevant to the question. |